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FIG. 25—COLUMNAR SWISS STONE PINE.
*Pinus Cembra columnaris* Beiss.

Photo by Gustave Liebscher

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THE ASSOCIATES, through whose interest and generosity The *Bulletin* and certain other undertakings of the Arboretum are made possible, is an informal group of individuals interested in encouraging and furthering the educational and research endeavors of the Morris Arboretum. Further information concerning this organization will be sent on request.

# The Columnar Swiss Stone Pine

The Swiss Stone Pine, *Pinus Cembra,* is a five-needled pine native to the Swiss Alps and, in its variety *sibirica,* to northeastern Russia and Siberia. In its native haunts it makes a tall tree becoming relatively broad and often round-topped with age. The freely produced cones of this tree are 2 to 3 inches long but they never open. Their edible seeds seem to be scattered in nature purely through the agency of squirrels, mice and other animals who break the scales off the cones and carry the seeds to their often distant hoards. Since squirrels seem to have short memories for the location of some of their storehouses, a number of these seeds will escape further attention until they eventually develop into scattered stands of new pine trees. The wood of this species is relatively fine-grained and durable as well as being soft and easy to work. It is much used by the Swiss for the manufacture of toys, earrings and a variety of hand-carved objects.

In the Eastern United States the Swiss Stone Pine, although distinctly slow-growing, is a highly desirable species for ornamental use; it is usually pyramidal in shape and very compact. Furthermore, it seems to thrive in exposed positions on quite poor soils. A specimen of the type species to be seen at the Arboretum has been previously figured in the Bulletin on page 101 of Vol. 1, No. 8.

The subject of this note is the columnar variety of this pine, *Pinus Cembra columnaris,* a horticultural variant which, at least in this climate, seems to attain its height more rapidly than the species but which at the same time, as may be seen in Fig. 25, is much narrower in habit. One of three similar trees at the Morris Arboretum, the specimen illustrated has attained a height of 30 feet with a spread of only 7 feet 6 inches at an age of approximately 36 years. Although this columnar form has been cultivated for a considerable number of years in continental Europe and the United States it is nevertheless still comparatively rare. By the absence of references to this form in the best known reference works from England, one is led to believe that, rather surprisingly, it is not likely to be met in the gardens of that country.

Where space is limited, or where design calls for the employment of an arresting vertical of relatively coarse texture, here is a subject which can be recommended for addition to our present rather limited bill of fare in this category. At present it does not, unfortunately, seem to be available in commercial nurseries.

H.T.S.

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479
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# Lignum-Vitae at the Arboretum Mill

Without lubrication, an under-water Lignum-vitae bearing carrying the full weight of a 2-ton spinning water-power turbine has completed thirty years of uninterrupted service at the Arboretum. And it is still in excellent condition, capable, if called upon, to perform for many more years its gruelling task. That no metal or other material has ever been found or developed which under these severe conditions approaches in practical performance this remarkable natural wood is perhaps not generally known. A brief account may therefore be of interest.

The trees yielding this wood belong to the genus *Guaiacum* of the Zygophyllaceae (Caltrop family). The genus is represented on all West Indian islands, the northern coastal regions of Colombia and Venezuela, the western fringe of Central America and Mexico, and the southern shores of the Gulf of Mexico. One species occurs in the United States, *Guaiacum sanctum*, on some of the keys off southern Florida. *G. officinale* has been the preferred source of Lignum-vitae, although *G. sanctum* also enters commerce considerably. More recently other species, too, have assumed commercial importance, especially *G. guatemalense*.

Besides being very hard and heavy (the dry wood sinks in water like a stone), the wood is very durable. But it is not to these properties that it owes its name — the wood of life — but rather to its supposed extraordinary medicinal powers. Soon after the discovery of America, stories of its healing virtues heard from the natives of Santo Domingo were carried back to Spain and early came to the notice of the European medical profession. Lignum-vitae gained great prestige as a specific for many diseases, notably syphilis, and a very considerable literature developed concerning it. At the height of its vogue the wood sold for fantastic prices, so great was the medical demand for it.

In this connection it should be pointed out that the heartwood contains a colored resin (Guaiac) which on exposure to air (oxidation) undergoes a striking color change. It is not to be wondered at that unusual virtues and powers should have been attributed to a wood possessing such apparently mysterious properties. However, both the wood and the resin have long since lost all standing in legitimate medicine. But the reputation of Lignum-vitae as a wood is secure and growing.

Blackish with a greenish tinge, it is one of the hardest woods known. Besides, the fibers run obliquely both radially and tangentially in such fashion that it all but defies splitting. But these properties, very important as they are, do not alone account for the unmatched performance of Lignum-vitae when used for under-water bearings. The capstone is supplied by the abundantly contained resin which acts as a lubricant. In short, the wood is self-lubricating.

Lignum-vitae, because of its hardness, great strength, and tenacity, finds very successful use in such hard-service articles as pulleys, bowling balls, caster wheels, mallets, etc. But its most important use by far, and the one calling for the greatest endurance, is as bearings for the great propeller shafts in steamships, including giant liners and battleships. Record and Hess in their

FIG. 26. Inscription on newly inserted penstock timber at the Water Mill.

FIG. 27. Bottom iron support of turbine assembly showing portions of the four radiating arms. The mushroom-like disk in the center is the top of the Lignum-vitae bearing. The concentric striations are shallow grooves worn by the cup-like iron bearing attached to the bottom of the revolving turbine and engaging the wood bearing. The base of the Lignum-vitae bearing (not visible) is tapered and wedged firmly into a correspondingly tapered socket in the center of the iron support.

recent book* state that "steel and tube mills are using Lignum-vitae in increasing amounts to replace brass and babbit metal for bearings in roller mills and pumps as the initial cost is less than that of metal, the life is several times as long and lubrication is unnecessary."

Opportunity to inspect this Lignum-vitae bearing was presented when in 1943 the water turbine at the mill on Wissahickon Creek was overhauled. The hydraulic engineer pronounced the bearing good for many more years of service; but since it had worn down somewhat it was decided to replace it with a new full-length Lignum-vitae bearing. The general overhauling made this replacement a simple operation. The veteran now enjoys a richly merited pensioning in the Arboretum's collections.

On the occasion of reconditioning the turbine, all the wood installations in the mill-race and penstock were replaced. These, built about twenty years ago out of long-leaf, or Southern yellow, pine (*Pinus palustris*), had rotted and deteriorated to the point of uselessness. The replacements are constructed throughout of the heartwood of bald or southern cypress (*Taxodium distichum*) from northern coastal Florida. This choice grade of all-heart cypress was obtained from the J. Gibson McIlvain Co. of Philadelphia, well known dealers in southern cypress lumber. The courtesy of the firm in permitting the Arboretum to select the individual timbers used is gratefully acknowledged.

The scope of the construction and the considerations which led to the choice of bald cypress will be apparent from the accompanying photograph of the inscription on one of the constituent cypress beams at the upper end of the penstock or forebay (Fig. 26). The exacting construction work was skilfully carried out by the men of the Arboretum. As a result the water power installation which furnishes much of the water used in the Arboretum is again in excellent operating condition and should remain so for many years to come.

J. R. SCHRAMM

* Record, Samuel J., and Hess, Robert W. TIMBERS OF THE NEW WORLD. Yale Univ. Press, 1943.

# Plant Accessions of 1946

Living plant collections at the Morris Arboretum have been enriched by the acquisition of some particularly interesting plants and plant groups during the past season. From Mr. C. F. Jenkins we were pleased to receive several varieties of his favorite native hemlock including a splendid 10-foot specimen of the variety *compacta*. All of these are being used as fine background material in the new evergreen plantings surrounding the rose garden. Such plantings include predominantly boxwoods on the upper end and mixed groupings of Cephalotaxus and yews down either side. With the addition of 7 more varieties of boxwood from Swarthmore College, Princeton University, and Cornell University, as well as a set of 19 named forms from Hillier and Sons of England, the Arboretum collection in this genus becomes perhaps one of the most complete in this section of the country.

*Rhododendrons and Azaleas.* Late last season 25 plants of some of the best strains of the late Mr. C. O. Dexter's Fortunei hybrid rhododendrons were received from Mrs. Dexter of Sandwich, Mass. These plants, together with others already at the Arboretum, which flowered profusely this year, now form a special grouping on

the north slope near Germantown Avenue. When of full flowering size these Fortunei hybrids are exceedingly showy and represent a radical departure in Eastern rhododendron culture. They will be interesting to observe in the Philadelphia region. Cions of several additional selections have since been received from Mr. Samuel Everitt, while cuttings are being rooted of further color variations in the possession of Mr. Henry F. duPont.

In other rhododendrons a further donation of seeds of approximately 60 species from the Royal Botanic Garden at Edinburgh have made plants which will be ready for setting out this spring for general cultural and hardiness testing. A shade house of Shipmast Locust construction will soon be erected for use in this project. Other very acceptable acquisitions in rhododendrons and azaleas include pollen for hybridization purposes from Mr. Samuel Everitt, Mr. Charles Willing of Chestnut Hill, and from Swarthmore College. Cuttings from hardy azaleas have been received from F. D. Moore and Sons, Narberth. These nurseries have also recently presented the arboretum with a fine 18-ft. specimen of *Styrax obassia,* our original plant being lost following the severe winter of 1934-35. Both the Styrax and a shapely young Franklin Tree (*Franklinia alatamaha*), a gift last spring from Mrs. R. M. Hogue of Germantown, have been planted as background specimens in the new Germantown Avenue rhododendron area.

*The Clematis Group.* A collection of species and varieties of Clematis has already attained significant proportions at Chestnut Hill. Summer visitors are greeted by numerous showy blossoms on the Rose Garden balustrade and on posts erected this year through the lower conifer nursery. Some notable further gifts have been made to the collection this season. Among such welcome additions were plants of 8 varieties from J. I. George and Son of Fairport, New York, who have already contributed very many of our existing forms; plants of 8 species from Henry Kohankie and some of Painesville, Ohio; 3 species from the Morton Arboretum; 23 species and varieties from the Montreal Botanical Garden; cuttings of 5 varieties from Mrs. Charles Platt; as well as seeds of 18 further types from Mr. Louis Vasseur and the Botanic Gardens of New York, Basle, Ville de Nantes, Stockholm and Leningrad.

*A Testing Service.* Worthy of special note among the season's acquisitions are a number of plants contributed specifically for purposes of testing and appraisal under Philadelphia conditions. Examples of such plants are two new Kurume hybrid azaleas produced and contributed by the de Wilde Rhododendron Lake Nurseries, seven of the new *Azalea Vuykiana* named hybrids presented by the Vuyk Van Nes Nurseries, Inc., and from Andorra Nurseries a curious natural variant of *Rhododendron maximum.* Such plants as these will be incorporated in display groupings but they will also be subject to close observation for a number of flowering seasons, and on agreement with their donors, will not be distributed by the Arboretum until further permission is granted. This testing service for new varieties of woody plants is open to any who wish to avail themselves of it so long as realistic limitations are recognized regarding the numbers of seedling individuals which can be reasonably handled from a given source.

Other new plant varieties recently contributed for observation in this region include the Bartlett Chestnut (*Castanea mollissima var*) from the Bartlett Tree Research Laboratory, the "Christine Buisman" Elm, *Ulmus carpinifolia,* a Dutch Elm disease-resistant form from the U. S. Department of Agriculture, and the new Azalea "Mephistopheles," the hybrid *Rosa rubus* and two named hybrids of *Prunus incisa x campanulata* parentage from Captain Collingwood Ingram.

*Further additions.* Our standard collections have been further enhanced by grafts and cuttings of several unusual conifer variants, including the rare *Pinus densiflora oculis draconis,* from Col. R. H. Montgomery, by seeds of the hardy Cedar of Lebanon from the Arnold Arboretum, by budwood of several of Mr. Adolf Muller's Flowering Dogwood selections from the DeKalb Nurseries, by plants of *Gymnocladus, Clerodendron,* etc., from the Arboretum of the Barnes Foundation, as well as by plants of a fine collection of 27 species of *Cotoneaster* and various other genera from the nurseries of Princeton University. In the fernery may be seen some excellent Platyceras, a recent gift of Mrs. F. W. Dixon. A number of graft understocks in rhododendrons and conifers very kindly provided by Koster Nurseries of Bridgeton, N. J., were invaluable for the propagation of many of the above forms.

In all, a total in plants of 93 different species and varieties have been received during 1946, together with cuttings and cions of 124 additional species and varieties and 165 packages of seeds. With very few exceptions these many plant materials have been secured through the interest and generosity of friends of the Arboretum. To all of these friends, many of whom have not been mentioned by name in the foregoing paragraphs, our sincere thanks are expressed.

H.T.S.

# An Exhibit of Fruiting Shrubs for Fall Gardens

The Morris Arboretum, cooperating with Swarthmore College, Arthur Hoyt Scott Foundation, staged an exhibit of ornamental fruits at the fall flower show of the Pennsylvania Horticultural Society, November 8 to 10 in Swarthmore. The show drew a record breaking attendance of nearly 8000. The exhibit included fruits of more than 50 shrubs and trees which are among the best for fall color and interest in gardens.

Large branches were arranged as a shrub border with a neat edging of ivy and an undercover of gray, green or bronze foliage to set off the berries.

The long, warm fall and the heavy fruiting of plants this year produced an abundance of berries, contributing greatly to the success of the exhibit. Another factor was the selection of individual plants outstanding for their fruits. Many gardens could be lit with color and shining berries in the fall if one would select personally good fruiting plants. Some of the berries arousing the most interest were: the bright red, large-fruited pyracantha, contributed by Mrs. A. H. Scott; a lemon-yellow pyracantha; a type of *Viburnum dilatatum* with multi-colored fruit heads varying through shades of yellow, orange and red; the compact green clusters of *Phellodendron chinense;* a dusty rose-pink *Evonymus yedoensis;* and the tightly-clustered light-vermillion fruits of an *Ilex serrata.*

The exhibit was awarded a gold medal.

M. A. LANCASTER

# Notes From the Laboratory

## Spray Results

*Fermate for Black Spot on Roses.*—In normal seasons yellow Cuprocide has given good control of black spot of roses. During the wet summer of 1945, however, (precipitation June-August 4.6 inches above normal) control proved inadequate. Defoliation was so severe that growth was far below average and plant losses abnormally high during the succeeding winter. Fermate (1½-100) was used in place of Cuprocide during 1946. A sticker was employed as well as Nicotine and CPO when signs of aphids appeared. No sulphur was used. Spray applications followed a weekly schedule from May 25th to October 12th. In spite of an even wetter season during 1946 (precipitation June-Aug. 6.2 inches above normal) control of black spot by the use of Fermate was the best that has been observed in several years at the Arboretum. Very little leaf infection was seen during the entire season and, as a probable result of practically no leaf loss, and in spite of their weakened condition at the beginning of the year, the growth of many varieties was almost phenomenal.

*DDT on Bald Cypress and Boxwood.*—Bald Cypress (*Taxodium distichum*) is subject to attack by the Cypress Tip Moth, *Recurvaria apicitripunctella.* In a previous report (*Morris Arb. Bull.,* Vol. 4, No. 4) a lead arsenate spray at the time of greening was recommended as a satisfactory control. Last spring a 40% DDT wettable powder containing a spreader but with sticker added and used at the rate of 2 lbs. per 100 gallons, was substituted for the arsenate greening spray. No control was achieved until the normal arsenate spray was applied ten days later.

During the past season emergence and flight of the Boxwood leaf miner, *Monarthropalpus buxi,* commenced at the Arboretum on June 7th at 10:30 A.M. with three specimens of *Buxus microphylla japonica.* Emergence from these and several varieties of *Buxus sempervirens* continued for a week during a period of cool and showery weather. A spray of DDT was applied on June 7th, and because of subsequent rains this was repeated on the 11th and again on the 14th. A good kill of flying adults was observed following each application, yet emergence from the leaf undersides continued as well as intermittent oviposition in young shoots of the sprayed shrubs. On September 9th, 50 leaves per plant taken from current season shoots, random selection, of 8 varieties of Boxwood were examined for second generation infestation. This

count revealed an average number of active larvae per leaf as follows:

| | |
|---|---|
| *Buxus microphylla japonica* | 4.4 |
| *Buxus sempervirens arborescens* | 1.2 |
| *Buxus sempervirens aureo variegata* | 1.2 |
| *Buxus sempervirens elegantissima* | 0.0 |
| *Buxus sempervirens Handsworthii* | 0.3 |
| *Buxus sempervirens myrtifolia* | 1.0 |
| *Buxus sempervirens rotundifolia* | 1.2 |
| *Buxus sempervirens suffruticosa* | 0.0 |

Twenty-two feeding larvae were noted in a single leaf of *Buxus microphylla japonica*. With no spray protection, leaf miner attack on the varieties *elegantissima, Handsworthii* and *suffruticosa* is normally light. Control with DDT was not considered satisfactory.

## Tree Feeding

Several types of fertilizers have been used in the maintenance program with 126 of the mature shade trees in the Arboretum. The most extensive treatments in 1938-40 were with an 11-5-6 fertilizer applied variously in fall or spring at the rate of 2 lbs. per inch of trunk circumference at 4½ feet above ground. Application was by the crowbar method either within a 4-foot wide zone centered at crown spread or at 3-foot intervals within the area of branch coverage. Supplementary or independent treatments included the use of Bovung, additional bonemeal, mulches and cultivation treatments of peat moss cow manure, sludge, leaf mold, etc. Twig elongation counts have usually indicated a positive response to artificial fertilizers, with shoot growth increases in the general range of 10-70%; but this is actually a very small amount, scarcely to be considered significant in view of the fact that untreated trees during favorable growing seasons have often done far better. Increases up to 270% have followed the use of cow manure applied in the fall to a variety of European Beech and so far no other material or combination of materials has been found to equal it. During an earlier 3-year period the same tree had given very little response to nearly 1000 lbs. of chemical fertilizer.

Before investigating other methods of restoring needed vigor to some of these trees it was decided to run one further test of chemical fertilizers on thirteen representative tree types. Some of these trees are growing in the rather shallow and gravelly neutral to acid soil of the hill-top near the Administration Building while others are in deeper soil in the south valley. None had been fertilized during the previous four years. Six additional trees were selected as checks. Commencing on April 22nd, 1946, each tree was fed with an 11-5-4 fertilizer (ammonium sulphate, superphosphate and muriate of potash)

| | Pounds of Fertilizer | Shoot growth in inches and as percentage of growth in 1944 | | |
|---|---|---|---|---|
| | 1946 | 1944 | 1945 | 1946 |
| *Abies cilicica* | 40 | 3.1<br>100% | 2.6<br>85% | 2.9<br>92% |
| *Abies lasiocarpa arizonica* | 20 | 2.3<br>100% | 1.6<br>70% | 1.5<br>66% |
| *Carya ovata* | 155 | 2.5<br>100% | 1.3<br>54% | 2.3<br>92% |
| *Cedrus atlantica argentea* | 95 | 2.0<br>100% | 1.5<br>75% | 1.5<br>72% |
| *Cladrastis lutea* | 160 | 5.8<br>100% | 3.4<br>58% | 7.9<br>135% |
| *Cornus florida* (2 together) | 195 | 3.4<br>100% | 3.4<br>100% | 3.8<br>110% |
| *Cornus florida pendula* | 85 | 8.6<br>100% | 7.4<br>86% | 6.1<br>70% |
| *Diospyros virginiana* | 100 | 6.5<br>100% | 5.2<br>81% | 4.5<br>69% |
| *Fagus sylvatica var.* | 240 | 3.4<br>100% | 2.7<br>79% | 3.9<br>115% |
| *Fraxinus excelsior aurea* | 150 | 3.1<br>100% | 3.3<br>108% | 2.7<br>87% |
| *Picea pungens glauca* | 80 | 3.3<br>100% | 3.2<br>98% | 3.1<br>96% |
| *Prunus subhirtella pendula* | 60 | 7.2<br>100% | 8.5<br>118% | 12.0<br>166% |
| *Quercus conferta* | 225 | 3.8<br>100% | 3.5<br>92% | 3.4<br>90% |
| Av. growth all treated trees | | 4.2<br>100% | 3.6<br>85% | 4.1<br>97% |
| *Carya ovata* | None | 5.4<br>100% | 5.8<br>109% | 3.8<br>71% |
| *Cedrus atlantica* | None | 5.0<br>100% | 2.9<br>58% | 3.0<br>61% |
| *Cornus florida* | None | 4.6<br>100% | 2.9<br>64% | 3.4<br>74% |
| *Fagus sylvatica atropunicea* | None | 4.5<br>100% | 3.6<br>78% | 4.9<br>107% |
| *Fraxinus excelsior* | None | 3.8<br>100% | 7.1<br>188% | 6.6<br>175% |
| *Prunus subhirtella pendula* | None | 17.4<br>100% | 11.8<br>68% | 12.0<br>69% |
| Av. growth all checks | | 6.8<br>100% | 5.7<br>94% | 5.6<br>93% |

FIG. 28. A comparison of shoot growth for the years 1944, '45 and '46. Thirteen species were fertilized in April, 1946. Six species received no treatment.

in an amount arrived at by addition of height in feet to spread in feet to trunk circumference in inches—expressed in lbs. of fertilizer. This poundage was reduced by 25%—40% for the conifers. Application was at 3-foot intervals from trunk to branch spread with the use of a water fertilizing gun operated at 300 lbs. pressure Calculation of amount and mode of application followed essentially the St. Louis method described by Beilman (Missouri Bot. Gard. Bul. 27:8, p. 119. Also Nat. Shade Tree Conf. *Proceedings,* V. 10, 1934, p. 114).

In spite of the heavy applications involved, and in spite of a soil which for a few trees was so shallow that the gun could be sunk only 8 or 10 inches before striking bed rock, no injury whatever was noted. During the growing season few effects of any kind could actually be detected. In some cases the foliage appeared to be improved in color and with European Beech and especially Weeping Dogwood it was increased considerably in size. Measurements were made in the fall of twig elongation for the past 3 years for 30 twigs on each tree (See Fig. 29). This average growth expressed in inches and as percentage increase or decrease over 1944 is shown in Fig. 28. Taken as a whole, the effect of these particular treatments upon subsequent growth is very slight indeed. Fertilized trees average slightly more growth than checks but any improvement is at best less than normal seasonal variation. The Yellow-wood (*Cladrastis*) and Weeping Cherry probably received some benefit but the Weeping Dogwood, in spite of improved foliage, made less growth than before. No conifer gave any significant response.

It is worthy of note that in spite of wet summers low precipitation during March and April has been reflected in generally diminished tree growth during both 1945 and 1946. Whether this program would have been productive of better results in a season of normally distributed rainfall is open to question. Whether a carry-over effect may be observed during the coming year is yet to be determined. One point concerning these trees at least receives emphasis,—the need for a careful investigation of limiting growth factors *other* than nitrogen, phosphorus and potash as they apply to the particular environment and soil type of the Morris Arboretum.

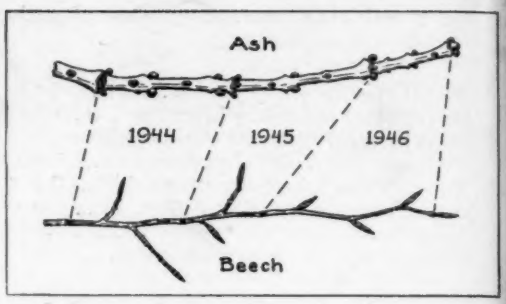


FIG. 29. The method of growth measurement. Comparisons of annual growth for three or more years are made *on the same shoot.* Averages for a series of shoots measured in this way provide a reliable seasonal growth index. All species under consideration make annual growth which can be readily recognized for several seasons past because of the prominent enduring bud scale scars.

HENRY T. SKINNER